

(Claims amended on November 27, 2003 under PCT Art. 34)

(Claims amended on November 3, 2003 under PCT Art. 34)

ART 34 AMDI

#### Claims

1. A process for producing a group III nitride semiconductor substrate, characterized in that the process comprises steps of:

forming a film containing metal element on a base substrate,

forming a group III nitride semiconductor layer including region of

5 voids therein on the metal element-containing film to be brought into direct contact therewith, and

peeling said base substrate with use of said region of voids as the site for peeling to take it away.

2. A process for producing a group III nitride semiconductor substrate claimed in Claim 1,

5 wherein said metal element-containing film contains a metal element possessing a decomposing action on said group III nitride semiconductor.

3. A process for producing a group III nitride semiconductor substrate claimed in Claim 2,

wherein said metal element is a transition element.

4. A process for producing a group III nitride semiconductor substrate claimed in Claim 2,

5 wherein said metal element is scandium, yttrium, titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, rhenium, iron, ruthenium, osmium, cobalt, rhodium, iridium, nickel, palladium, manganese, copper, platinum or gold.

5. A process for producing a group III nitride semiconductor substrate claimed in Claim 4,

wherein said metal element is titanium, zirconium, hafnium, tantalum, platinum, cobalt or nickel.

6. A process for producing a group III nitride semiconductor substrate, characterized in that the process comprises steps of:

forming a film containing metal element on a base substrate,  
growing a first group III nitride semiconductor layer on the metal element-containing film to be brought into direct contact therewith,  
heat-treating said metal element-containing film and said first group III nitride semiconductor layer at a temperature higher than said growth temperature for the first group III nitride semiconductor layer to form region of voids in said first group III nitride semiconductor layer,  
forming a second group III nitride semiconductor layer on said first group III nitride semiconductor layer, and  
peeling said base substrate with use of said region of voids as the site for peeling to take it away.

7. A process for producing a group III nitride semiconductor substrate claimed in Claim 6,

wherein said growth temperature for the first group III nitride semiconductor layer is within the range of 400°C or higher but 800°C or lower.

8. A process for producing a group III nitride semiconductor substrate claimed in Claim 6 or 7,

wherein the heat treatment of said metal element-containing film and said first group III nitride semiconductor layer is conducted at a temperature of 900°C or higher but 1,400°C or lower

9. A process for producing a group III nitride semiconductor substrate claimed in Claim 6,

wherein the thickness of said first group III nitride semiconductor layer is in the range of 20 nm or thicker but 2,000 nm or thinner.

10. A process for producing a group III nitride semiconductor substrate claimed in Claim 6,

wherein said metal element-containing film is a metal film.

11. A process for producing a group III nitride semiconductor substrate claimed in Claim 6,

wherein said metal element-containing film contains a metal element having a decomposing action on the group III nitride semiconductor.

12. A process for producing a group III nitride semiconductor substrate claimed in Claim 11,

wherein said metal element is a transition element.

13. A process for producing a group III nitride semiconductor substrate claimed in Claim 11,

wherein said metal element is scandium, yttrium, titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, rhenium, iron, ruthenium, osmium, cobalt, rhodium, iridium, nickel, palladium, manganese, copper, platinum or gold.

14. A process for producing a group III nitride semiconductor substrate claimed in Claim 13,

wherein said metal element is titanium, zirconium, hafnium, tantalum, platinum, cobalt or nickel.

15. A process for producing a group III nitride semiconductor substrate, characterized in that the process comprises steps of:

forming, on a base substrate, a metal element-containing film having a fine pore structure therein,

5           forming a group III nitride semiconductor layer including region of voids therein on the metal element-containing film to be brought into direct contact therewith, and

          peeling said base substrate with use of said region of voids as the site for peeling to take it away.

16.       A process for producing a group III nitride semiconductor substrate claimed in Claim 15,

          wherein said metal element-containing film contains a metal element possessing a decomposing action on the group III nitride semiconductor.

17.       A process for producing a group III nitride semiconductor substrate claimed in Claim 16,

          wherein said metal element is a transition element.

18.       A process for producing a group III nitride semiconductor substrate claimed in Claim 16,

          wherein said metal element is scandium, yttrium, titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, rhenium, iron, ruthenium, osmium, cobalt, rhodium, iridium, nickel, palladium, manganese, copper, platinum or gold.

19.       A process for producing a group III nitride semiconductor substrate claimed in Claim 18,

          wherein said metal element is titanium, zirconium, hafnium, tantalum, platinum, cobalt or nickel.

20.       A process for producing a group III nitride semiconductor substrate, characterized in that the process comprises steps of:

          forming, on a base substrate, a metal element-containing film, at least the surface of which is composed of a metal nitride,

5 carrying out treatment for elimination of the nitrogen contained in  
said metal nitride,

forming a group III nitride semiconductor layer including region of  
voids therein on the metal element-containing film to be brought into  
direct contact therewith, and

10 peeling said base substrate with use of said region of voids as  
the site for peeling to take it away.

21. A process for producing a group III nitride semiconductor  
substrate claimed in Claim 20,

wherein said step of forming the metal element-containing film  
comprises, after formation of a metal film on said base substrate, a step  
5 of treatment for nitrification of the metal film.

22. A process for producing a group III nitride semiconductor  
substrate claimed in Claim 20,

wherein said metal element-containing film is a metal nitride film.

23. A process for producing a group III nitride semiconductor  
substrate claimed in Claim 20,

wherein said treatment for elimination of nitrogen is a treatment in  
which said metal element-containing film is exposed to a reducing  
5 atmosphere.

24. A process for producing a group III nitride semiconductor  
substrate, characterized in that the process comprises steps of:

forming, on a base substrate, a metal element-containing film, at  
least the surface of which is composed of a metal nitride,

5 growing a group III nitride semiconductor layer on the metal  
element-containing film to be brought into direct contact therewith under  
condition that a V/III ratio of raw material gas is set to be 10 or less to

form group III nitride semiconductor layer including region of voids therein,  
and

5                   peeling said base substrate with use of said region of voids as  
the site for peeling to take it away.

25.       A process for producing a group III nitride semiconductor  
substrate claimed in Claim 24,

                  wherein said metal element-containing film contains a metal  
element having a decomposing action on the group III nitride  
5       semiconductor.

26.       A process for producing a group III nitride semiconductor  
substrate claimed in Claim 25,

                  wherein said metal element is a transition element.

27.       A process for producing a group III nitride semiconductor  
substrate claimed in Claim 25,

                  wherein said metal element is scandium, yttrium, titanium,  
zirconium, hafnium, vanadium, niobium, tantalum, chromium,  
5       molybdenum, tungsten, rhenium, iron, ruthenium, osmium, cobalt,  
rhodium, iridium, nickel, palladium, manganese, copper, platinum or gold.

28.       A process for producing a group III nitride semiconductor  
substrate claimed in Claim 27,

                  wherein said metal element is titanium, zirconium, hafnium,  
tantalum, platinum, cobalt or nickel.

29.       A process for producing a group III nitride semiconductor  
substrate claimed in any one of Claims 1, 6, 15, 20 and 24,

                  wherein said metal element -containing film is formed on the  
whole surface of said base substrate.

30.       (cancelled)

31. (amended) A process for producing a group III nitride semiconductor substrate claimed in any one of Claims 1, 6, 15, 20 and 24,

wherein said step of peeling said base substrate to take it away comprises a step of cooling down the temperature of the atmosphere post to the growth of the group III nitride semiconductor layer to spontaneously peel said base substrate off.

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32. (amended) A group III nitride semiconductor substrate being produced by using a process for producing a group III nitride semiconductor substrate as claimed in any one of Claims 1, 6, 15, 20 and 24 .